comprising time/frequency transforming means for transforming said discrete multitone signals into a discrete multitone symbol of frequency components and demapping means for outputting for each frequency component a symbol of a constellation nearest to each frequency component and corresponding demodulated data, the far-end crosstalk canceling circuit comprising:

estimation means, in at least one line termination modem, for estimating constellation symbols actually sent by the network termination modems from the frequency components of the discrete multitone symbols generated by the plurality of line termination modems;

calculation means for calculating a linear combination of said estimated constellation symbols, subtracting said linear combination from the frequency components generated by said at least one line termination modem, and applying a resulting difference to the demapping means of the at least one line termination modem;

error calculation means for calculating an error distance between the symbol of the constellation output from the at least one line termination modem and said resulting difference; and

updating means for updating coefficients of said linear combination as a function of said error distance.

2.   (Amended) The far-end crosstalk canceling circuit of claim 1, wherein the estimation means further comprises means for providing the symbols of the constellations respectively output by the demapping means of the plurality of line termination modems as estimates of modulated data sent by the corresponding network termination modems.

3.   (Amended) The far-end crosstalk canceling circuit of claim 1, wherein the estimation means further comprises switching means for outputting the frequency components in a first step, and the estimated constellation symbols obtained therefrom in a second step.

4.   (Amended) The far-end crosstalk canceling circuit of claim 1, wherein:
the estimation means is common to all of the plurality of line termination modems and simultaneously provides the discrete multitone symbols as estimates for consecutive constellation symbols;

the calculating means is common to all of the plurality of line termination modems and comprises matrix calculation means calculating at time t a product $H^{-1}_{t-1}*R$ of a matrix H^{-1}_{t-1} with a vector R, R being constituted by all sets of frequency components Ri, the matrix H^{-1}_{t-1} being an estimate at time t-1 of an inverse of a transfer matrix of the plurality of transmission channels;

the error calculating means is common to all of the plurality of line termination modems and calculates the error distance as between each of n components of the product $H^{-1}_{t}*R$ and the symbols of the constellations output by the respective demapping means of the plurality of line termination modems; and

the updating means is common to all of the plurality of line termination modems and updates coefficients of the matrix H^{-1}_{t-1} as a function of said error distance.

5. (Amended) The far-end crosstalk canceling circuit of claim 1, further comprising parallel to serial converters for transforming the sets of frequency components Ri into respective serial streams of frequency components, wherein:

the estimation means is common to all of the plurality of line termination modems and simultaneously provides the frequency components as estimates for the constellation symbols;

the calculating means is common to all of the plurality of line termination modems and comprises matrix calculation means sequentially calculating at time t, for each tone j a product $H^{-1}_{t-1}(fj)*R(fj)$ of a matrix $H^{-1}_{t-1}(fj)$ with a vector R(fj) constituted by all the frequency components Ri(fj) at a frequency fj, $H^{-1}_{t-1}(fj)$ being an estimate at time t-1 of an inverse of a transfer matrix at the frequency fj of the plurality of transmission channels;

the error calculating means is common to all of the plurality of line termination modems and sequentially calculates for each tone j the error distance as between each of the n

components of the product $H^{-1}_{t}(fj)*R(fj)$ and constellation points $\hat{S}$ i(fj) output by the respective demapping means of the plurality of line termination modems;

the updating means is common to all of the plurality of line termination modems and sequentially updates for each tone j coefficients of the matrix $H^{-1}_{t-1}(fj)$ as a function of said error distance.

6. (Amended) A digital subscriber line transmission system comprising a far-end

crosstalk canceling circuit according to claim 4, in which the plurality of line termination modems and corresponding network termination modems are of a synchronous Zipper type.

7. (Amended) A far-end crosstalk canceling method for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems adapted to receive discrete multitone signals from corresponding network termination modems over a plurality of transmission channels, each of the plurality of line termination modems comprising frequency transforming means for transforming said discrete multitone signals into a discrete multitone symbol of frequency components, and demapping means for outputting for each frequency component a symbol of the constellation nearest to each frequency component and corresponding demodulated data, the method comprising the steps of:

estimating, for at least one line termination modem, constellation symbols actually sent by the network termination modems, from the frequency components of the discrete multitone symbols generated by the plurality of line termination modems;
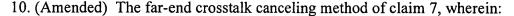
calculating a linear combination of said estimated constellation symbols, subtracting said linear combination from the frequency components generated by the at least one line termination modem, and applying a resulting difference to the demapping means of the at least one line termination modem, to obtain the symbol of the constellation;

calculating the error distance between the symbol of the constellation and said resulting difference; and

updating coefficients of said linear combination as a function of said error distance.

8. (Amended) The far-end crosstalk canceling method of claim 7, wherein the step of estimating further comprises providing the symbols of the constellations respectively output by the demapping means of the plurality of line termination modems as estimates of modulated data sent by the corresponding network modems.

9. (Amended) The far-end crosstalk canceling method of claim 7, wherein the step of estimating further comprises providing the frequency components in a first step and the estimated constellation symbols obtained therefrom in a second step.

10. (Amended) The far-end crosstalk canceling method of claim 7, wherein:

the step of estimating is carried out for all of the plurality of line termination modems and simultaneously provides the frequency components as estimates for consecutive constellation symbols;

the step of calculating is carried out for all of the plurality of line termination modems and comprises calculating at step t a product $H^{-1}_{t-1}*R$ of a matrix H^{-1}_{t-1} with a vector R, R being constituted by n discrete multitone symbols Ri, the matrix H^{-1}_{t-1} being an estimate at step t-1 of an inverse of a transfer matrix of the plurality of transmission channels;

the step of calculating the error distance is carried out for all of the plurality of line termination modems and calculates the error distance as between each of n components of the product $H^{-1}_{t-1}*R$ and the symbols of the constellation output by the respective demapping means of the plurality of line termination modems; and

the act of updating is carried out for all of the plurality of line termination modems and updates coefficients of the matrix H^{-1}_{t-1} as a function of said error distance.

11. (Amended) The far-end crosstalk canceling method of claim 7, further comprising a step of:

parallel to serial converting the discrete multitone symbols into respective serial streams of frequency components;
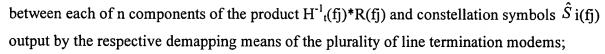
wherein:

the step of estimating is carried out for all of the plurality of line termination modems and simultaneously provides the frequency components as estimates for the constellation symbols;

the step of calculating is carried out for all of the plurality of line termination modems and sequentially calculates at step t, for each tone j, a product $H^{-1}_{t-1}(fj)*R(fj)$ of a matrix $H^{-1}_{t-1}(fj)$ with a vector R(fj) constituted by all the frequency components Ri(fj) at a frequency fj, $H^{-1}_{t-1}(fj)$ being an estimate at time t-1 of an inverse of a transfer matrix at the frequency fj of the plurality of transmission channels;

the step of calculating an error distance is carried out for all of the plurality of line termination modems and sequentially calculates, for each tone j, a sum of the error distance as

between each of n components of the product $H^{-1}_t(fj)*R(fj)$ and constellation symbols $\hat{S}i(fj)$ output by the respective demapping means of the plurality of line termination modems;

the step of updating is carried out for all of the plurality of line termination modems and sequentially updates for each tone j coefficients of the matrix $H^{-1}_{t-1}(fj)$ as a function of said error distance.

Please add new claims 12-39 as follows:

12.   (New) In a communication system including a first phase modulated carrier signal and a plurality of second phase modulated carrier signals, the first phase modulated carrier signal and the plurality of second phase modulated carrier signals having a same carrier frequency, a method comprising an act of:

a) applying a linear combination of estimated complex symbols derived from the plurality of second phase modulated carrier signals to a first complex symbol derived from the first phase modulated carrier signal.

13.   (New) The method of claim 12, wherein the act a) further comprises an act of reducing far-end crosstalk in the first phase modulated carrier signal.

14.   (New) The method of claim 12, wherein the first phase modulated carrier signal includes a first quadrature amplitude modulated carrier signal, wherein the plurality of second phase modulated carrier signals includes a plurality of second quadrature amplitude modulated carrier signals, and wherein the act a) comprises an act of:

applying the linear combination of the estimated complex symbols derived from the plurality of second quadrature amplitude modulated carrier signals to the first complex symbol derived from the first quadrature amplitude modulated carrier signal.

15.   (New) The method of claim 12, wherein the act a) further comprises an act of:

b) calculating the linear combination of estimated complex symbols based on a plurality of weighting values associated with the plurality of second phase modulated carrier signals.

16.   (New) The method of claim 15, wherein the act b) further comprises acts of:

multiplying each estimated complex symbol of the estimated complex symbols by a corresponding one of the plurality of weighting values to generate a plurality of weighted estimated complex symbols; and

calculating a sum of the plurality of weighted estimated complex symbols to generate the linear combination.

17.   (New) The method of claim 12, wherein the act a) further comprises an act of:

subtracting the linear combination of estimated complex symbols from the first complex symbol to generate a third complex value.

18.   (New) The method of claim 17, further comprising acts of:

demapping the third complex value to a phase modulation constellation point;

making a comparison of the phase modulation constellation point and the third complex value; and

generating an error value based on the comparison.

19.   (New) The method of claim 18, further comprising an act of:

updating, based on the error value, at least one of a plurality of weighting values associated with the plurality of second phase modulated carrier signals.

20.   (New) The method of claim 19, further comprising acts of:

multiplying, after the act of updating, each estimated complex symbol of the estimated complex symbols by a corresponding one of the plurality of weighting values, to generate a plurality of weighted estimated complex symbols; and

calculating a sum of the plurality of weighted estimated complex symbols to generate the linear combination.

21.   (New) The method of claim 18, wherein the act of making a comparison of the phase modulation constellation point and the third complex value comprises subtracting the phase modulation constellation point from the third complex value.

22.   (New) The method of claim 18, wherein the act of demapping the third complex value further comprises generating a digital word corresponding to the third complex value.

23.   (New) In a communication system including a first phase modulated carrier signal and a plurality of second phase modulated carrier signals, the first phase modulated carrier signal and the plurality of second phase modulated carrier signals having a same carrier frequency, an apparatus comprising:

a controller to apply a linear combination of estimated complex symbols derived from the plurality of second phase modulated carrier signals to a first complex symbol derived from the first phase modulated carrier signal.

24.   (New) The apparatus of claim 23, wherein the controller is adapted to reduce far-end crosstalk in the first phase modulated carrier signal.

25.   (New) The apparatus of claim 23, wherein the first phase modulated carrier signal includes a first quadrature amplitude modulated carrier signal, wherein the plurality of second phase modulated carrier signals includes a plurality of second quadrature amplitude modulated carrier signals, and wherein the controller applies the linear combination of the estimated complex symbols derived from the plurality of second quadrature amplitude modulated carrier signals to the first complex symbol derived from the first quadrature amplitude modulated carrier signal.

26.   (New) The apparatus of claim 23, wherein the controller comprises a calculator to calculate the linear combination of symbols based on a plurality of weighting values associated with the plurality of second phase modulated carrier signals.

27.   (New) The apparatus of claim 26, wherein the calculator comprises:

a multiplier to multiply each estimated complex symbol of the estimated complex symbols by a corresponding one of the plurality of weighting values to generate a plurality of weighted estimated complex symbols; and

an adder to calculate a sum of the plurality of weighted estimated complex symbols to generate the linear combination.

28.   (New) The apparatus of claim 23, wherein the controller further comprises a first subtractor to subtract the linear combination of estimated complex symbols from the first complex symbol to generate a third complex value.

29.   (New) The apparatus of claim 28, wherein the controller further comprises:

a demapper to demap the third complex value to a phase modulation constellation point; and

a comparator to make a comparison of the phase modulation constellation point and the third complex value to generate an error value.

30.   (New) The apparatus of claim 29, wherein the controller further comprises:

a processor to update, based on the error value, at least one of a plurality of weighting values associated with the second phase modulated carrier signals.

31.   (New) The apparatus of claim 30, wherein the controller further comprises:

a multiplier to multiply each complex symbol of the estimated complex symbols by a corresponding one of the plurality of weighting values to generate a plurality of weighted estimated complex symbols; and

an adder to calculate a sum of the plurality of weighted estimated complex symbols to generate the linear combination.

32.   (New) The apparatus of claim 29, wherein the comparator further comprises a second subtractor to subtract the phase modulation constellation point from the third complex value.

33.   (New) The apparatus of claim 29, wherein the demapper generates a digital word corresponding to the third complex value.

34.   (New) The apparatus of claim 23, wherein the communication system includes at least one modem coupled to the controller, and wherein the apparatus includes the controller in combination with the at least one modem.

35.   (New) The combination of claim 34, wherein the at least one modem includes the controller.

36.   (New) A method for reducing far-end crosstalk in a communication system including at least a first phase modulated carrier signal and a second phase modulated carrier signal, the first and second phase modulated carrier signals having a same carrier frequency, the method comprising acts of:

a) making a first estimation of a first complex symbol derived from at least the second phase modulated carrier signal;

b) making a first comparison of the first estimation of the first complex symbol and a second complex symbol derived from the first phase modulated carrier signal;

c) generating a third complex value based on the first comparison;

d) demapping the third complex value to a phase modulation constellation point and a corresponding digital output;

e) making a second comparison of the phase modulation constellation point and the third complex value;

f) generating an error value based on the second comparison; and

g) making a second estimation of the first complex symbol based on the error value.

37.   (New) The method of claim 36, further comprising acts of:

h) repeating the acts b) through f), substituting the second estimation of the first complex symbol for the first estimation of the first complex symbol; and

i) making a third estimation of the first complex symbol based on the error value.

38.   (New) The method of claim 36, wherein the second phase modulated carrier signal includes a plurality of second phase modulated carrier signals, and wherein the act a) further comprises acts of:

a1) estimating a plurality of complex symbols derived from the plurality of second phase modulated carrier signals; and

a2) calculating a linear combination of the plurality of estimated complex signals to generate the first complex symbol.

39.   (New) An apparatus for reducing far-end crosstalk in a communication system including at least a first phase modulated carrier signal and a second phase modulated carrier signal, the first and second phase modulated carrier signals having a same carrier frequency, the apparatus comprising:

a) means for making a first estimation of a first complex symbol derived from at least the second phase modulated carrier signal;

b) means for making a first comparison of the first estimation of the first complex symbol and a second complex symbol derived from the first phase modulated carrier signal;

c) means for generating a third complex value based on the first comparison;

d) means for demapping the third complex value to a phase modulation constellation point and a corresponding digital output;

e) means for making a second comparison of the phase modulation constellation point and the third complex value;

f) means for generating an error value based on the second comparison; and

g) means for making a second estimation of the first complex symbol based on the error value.